

#### 4.5.6.7.2 *Administrative Implementability*

It is not clear whether the ASC systems are administratively implementable. An NPDES permit is required for discharging treated water from the P&T and from upgradient dewatering wells. See Exhibit 3.2-1, which shows the permits and approvals needed for ASC. Lehigh's preliminary research suggests that ASC will meet the conditions connected with these permits and approvals. However, portions of ASC likely will extend off Lehigh-owned property (e.g., slurry wall alignment along Quarry Road). Lehigh not know whether using this land is feasible.

#### 4.5.6.8 ASC-Consideration of Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

#### 4.5.7 **ASC-Provide a Reasonable Restoration Time Frame**

Lehigh has proposed a conditional POC because ASC will not meet cleanup levels throughout the entire Site. It is difficult to precisely estimate when groundwater downgradient of the ASC will meet the cleanup levels for pH and arsenic at the conditional POC. However, the performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress toward meeting groundwater restoration. The ASC will operate indefinitely to maintain compliance with cleanup standards.

The ASC will achieve compliance with groundwater cleanup levels at a conditional POC in approximately the same time frame as other alternatives evaluated in this Revised dFSTR. The detailed design phase will more fully evaluate the restoration time frame for the ASC.

#### 4.5.8 **ASC-Consider Public Concerns**

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

#### **4.5.9 ASC-Prevent Domestic Use of CKD-Affected Groundwater**

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.

### **4.6 Partial Source Removal (PSR)**

#### **4.6.1 PSR-Alternative Description**

##### **4.6.1.1 General**

Alternative #4 – Partial Source Removal (PSR) removes CKD from certain areas of the Closed CKD Pile to reduce the amount of CKD in contact with groundwater based on Ecology interpretations of areas of inundation [Ecology, 1997]. Reducing CKD-water contact reduces the generation of CKD-affected groundwater. PSR also includes P&T components to treat affected groundwater that continues to emanate from the pile. Complete elimination of the CKD-water contact would be very difficult. Ecology believes that PSR will achieve sufficient removal of CKD-water contact to obviate groundwater treatment after residual groundwater effects are remediated. Although the exact time period that residual effects would attenuate is uncertain, Lehigh applied a five-year timeframe to Ecology's belief for the purposes of the Revised dFSTR. The five-year timeframe allows Ecology's PSR scenario to be costed and evaluated using the remedy selection criteria.

Lehigh believes that even implemented with a high degree of effectiveness, PSR will not result in groundwater remediation over the long-term and therefore, groundwater treatment would continue indefinitely. Lehigh has presented data and analysis that shows that PSR would need to be greater than 99% effective at removing the CKD-water contact. Lehigh also demonstrated that only full Closed CKD Pile removal will achieve this level of effectiveness because of the various mechanisms for water-CKD contact [GeoSyntec, 2004].

This section evaluates both Ecology's and Lehigh's views of the time needed for subsequent groundwater treatment. Both PSR groundwater treatment scenarios use

the same CKD removal, inert backfill, and off-site disposal components, but the groundwater treatment duration differs.

Removal operations target CKD near the toe of the Closed CKD Pile and CKD inundated by groundwater in the lowest reaches of the pile. Sheet piles around the toe area isolate and stabilize the toe, followed by excavation of the CKD. The analysis examined two excavation methods for the lower reaches of the Closed CKD Pile: (1) conventional slope-back excavation through the top of the Closed CKD Pile, and (2) a coffer dam type system, using vertical shoring installed through the top of the Closed CKD Pile to allow excavation of a near-vertical shaft.

The conventional slope-back technique has significant advantages over the coffer dam system, as follows:

- Excavating the silt-like CKD using a vertical shaft poses significant safety concerns;
- The vertical distance between the top and lower reaches of the Closed CKD Pile is between 60 and 100 feet. Advancing shoring to these depths on the Closed CKD Pile would be difficult;
- The footprint of the targeted area, approximately 330 feet by 120 feet, is a rather large area to stabilize with a system of vertical shoring that requires structural integrity;
- Cross braces needed to provide horizontal support to the vertical shoring will impede the maneuvering of the excavation equipment;
- Advancing shoring through the top of the Closed CKD Pile may destabilize the slopes of the Closed CKD Pile;
- Large objects, such as boulders, will interfere with shoring advancement; and

- Various excavation contractors<sup>21</sup> suggest that a conventional slope-back technique offers more control over the excavation and safety aspects of the project.

#### 4.6.1.2 System Description

The excavation at the toe of the Closed CKD Pile likely requires advance WDOT approval because of its proximity to State Route 31. Prior to excavation activities, land would also be secured for the purposes of construction and operation of a temporary storage facility approximately five acres in size. The storage location contains the excavated CKD in a lined pad in preparation for CKD replacement back into the excavations. The storage location is equipped with horizontal perforated pipes to collect drainage from the CKD, dust control water, and precipitation. Cover components from the Closed CKD Pile will be salvaged for re-use to the extent practical at a nearby location. A truck staging and cleaning area is also needed to handle the approximately 13,000 truck trips that result from PSR.

PSR then removes and replaces the following areas of the Closed CKD Pile and includes the listed components:

- ***Toe of Closed CKD Pile.*** Exhibit 4.6-1 shows the following general steps that will be taken to implement this alternative:
  1. Install dewatering wells at the downgradient toe adjacent to State Route 31.
  2. Access the top of the Closed CKD Pile and cut away the engineered cover system. Salvage components as much as possible.
  3. Place about 500 ft of sheet piles upgradient of the affected zone.

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<sup>21</sup> Lehigh and Ecology consulted several earthworks contractors during evaluation of PSR. The

4. Excavate approximately 5,500 cubic yards of CKD to the east of the sheet piles.
  5. Transport the 5,500 cubic yards of CKD using approximately 280 trucks to a temporary storage location.
  6. Put approximately 2,800 cubic yards of high-permeability engineered backfill into the bottom of the hole, surround it with geotextile filter fabric, and overlay it with a low-permeability soil cover.
  7. Bring approximately 2,700 cubic yards CKD back from temporary storage, via approximately 140 trucks, and backfill with the excavated CKD.
  8. Dispose of approximately 2,800 cubic yards of excess CKD in off-site landfill.
  9. Reconstruct the engineered cap over the Closed CKD Pile.
- ***Lower CKD Saturated Zones.*** To access the lower reaches of the pile and ensure stable CKD slopes inside of the excavation, conventional excavation entails excavating about half of the entire pile, or approximately 260,000 cubic yards. Such excavation requires the following general steps:
    1. Install groundwater dewatering wells at the downgradient toe and upgradient side of the Closed CKD Pile to lower the groundwater level below the CKD.
    2. Access the top of the Closed CKD Pile and cut away the engineered cover system. Salvage components as much as possible.

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contractors provided input on PSR constructability, safety, and cost.

3. Excavate approximately 260,000 cubic yards of CKD to the east of the sheet piles.
  4. Slope the excavation sides at a 2:1 (horizontal: vertical) slope, as excavation proceeds (see Exhibit 4.6-1) and removes the inundated CKD.
  5. Transport the 260,000 cubic yards of CKD using approximately 13,000 trucks to a temporary storage location.
  6. Put approximately 7,000 cubic yards of high-permeability engineered backfill into the bottom of the hole, surround it with geotextile filter fabric, and overlay it with a low-permeability soil cover.
  7. Bring approximately 253,000 cubic yards CKD back from temporary storage, via approximately 12,500 trucks, and backfill with the excavated CKD.
  8. Dispose of approximately 7,000 cubic yards of excess CKD in off-site landfill.
  9. Reconstruct the engineered cap over the Closed CKD Pile.
- **GWC.** Install GWC as described in Section 4.4.1.

#### 4.6.1.3 System Performance

PSR will excavate CKD from the base of the Closed CKD Pile, thus reducing the amount of CKD in contact with groundwater. This, in turn, will decrease the volume of CKD-affected groundwater. The P&T components downgradient from the Closed CKD Pile will intercept affected groundwater, extract it with pumps, and treat it aboveground by using carbon dioxide and ferric chloride. Carbon dioxide is the neutralization agent to lower pH, and ferric chloride precipitates the arsenic out of

solution by forming insoluble complexes. See section 4.3.1.3 for the rationale Lehigh used to select carbon dioxide as the neutralizing agent. Section 4.4.1.2 provides details on the behavior of ferric chloride flocculent. Preliminary calculations show that the relatively small dosage of ferric chloride will not contribute significant dissolved chloride to the treated water stream.

Ecology and Lehigh disagree about the duration of groundwater treatment needed to meet cleanup standards. Ecology believes that removing the two areas of saturated CKD shown on Exhibit 4.6-1 will result in groundwater that meets cleanup levels after short-term flushing. The Revised dFSTR assigns a time-period of five years to the short-term flushing.

Lehigh believes that, to meet cleanup standards, groundwater treatment will be required indefinitely [GeoSyntec, 2004]. Although removing much of the CKD in contact with groundwater will reduce the production of CKD-affected groundwater, water will continue to enter the Pile from other sources. Lehigh presented information showing that water enters the Pile via deep and side seeps. Even if all saturated portions of the CKD were removed so that no more water contacted CKD, transient drainage would still occur for decades (see Section 4.5.1.3). The elevated pH of this transient drainage will cause groundwater downgradient of the Closed CKD Pile to exceed cleanup standards.

This Revised dFSTR evaluates both groundwater treatment scenarios, five years and indefinite. For purposes of evaluating PSR under Ecology's groundwater treatment scenario, Lehigh assumes that cleanup levels will be met in groundwater throughout the Site after five years, at which time treatment will stop. The five-year assumption also allows Lehigh to prepare a cost estimate for this scenario. For purposes of evaluating PSR under the second groundwater treatment scenario, Lehigh believes that treatment must continue indefinitely to maintain compliance with cleanup levels at a conditional groundwater POC. In both scenarios, Lehigh will treat affected groundwater by using a GWC consisting of the Pilot System and P&T components installed downgradient of the Closed CKD Pile.

During installation of PSR, the contractors will perform soft soil excavation construction quality assurance tests. While the contractors will estimate the amounts of

CKD removed, it is not possible to calculate the percentage of the inundated CKD removed.

The PSR alternative evaluation assumes that much of the contact between CKD and groundwater will be removed by excavating and replacing two areas of CKD inundation. If desired, the information provides a basis for analyzing the removal of less inundated CKD. With a lesser alternative comes reduced control, reducing the benefits of the alternative. Please see Exhibit 4.6-2 and Appendix E for more detailed information on cost and assumptions.

#### 4.6.1.4 Construction Schedule

PSR design, contracting, and procurement requires approximately eight months. Procurement of the approximately five acres of temporary storage requires approximately six to nine months. PSR permitting and obtaining regulatory approvals requires approximately six months to one year (see Exhibit 3.2-1 for the list of permits and regulatory approvals). Building the approximately five-acre temporary storage area requires approximately one month. Excavation, removal, and backfill require approximately twenty-five to thirty months. Cleaning the five-acre temporary storage area requires approximately two months. Cover reconstruction requires approximately seven months. Hence, the total installation time for PSR is approximately thirty-five to forty months. This estimated timeframe does not account for construction during inclement weather or winter conditions. The winter temperatures and hours of daylight in Metaline Falls may adversely affect PSR during installation. When working with time frames for tasks that last longer than six months, the construction schedule may bridge over into a second construction season. As explained earlier, it is not advisable to implement PSR during the winter.

#### 4.6.2 PSR-Protect Human Health and the Environment

The PSR alternative protects human health and the environment for the following reasons:



- **Groundwater Quality.** Under the first groundwater treatment scenario, it is assumed that PSR meets MTCA groundwater cleanup levels at a standard POC after five years. Under the second scenario, PSR meets MTCA groundwater cleanup levels at a conditional POC.
- **ARAR Compliance.** PSR will comply with ARARs.
- **Institutional Controls.** Lehigh will use institutional controls as described in Section 4.2.2.

#### 4.6.3 PSR-Comply With Cleanup Standards

PSR will comply with cleanup standards assumed for the purposes of the Revised dFSTR, as follows:

- **Cleanup Levels (CLs).** The proposed groundwater cleanup levels for the Site are pH between 6.5 and 8.5, and maximum arsenic concentration of 5.0 ppb.
- **Point of Compliance (POC).** Under the first scenario, Ecology presumes a standard POC is used, and groundwater meets cleanup levels throughout the Site after five years. Under the second scenario, groundwater meets cleanup levels at a groundwater conditional POC between the P&T components and Sullivan Creek (Exhibit 4.6-1).

#### 4.6.4 PSR-Comply With Applicable Federal and State Laws

PSR complies with ARARs. A summary of ARARs that apply to this alternative is presented in Exhibit 3.2-1.

Calculations show that treatment residuals generated by the P&T component will not designate as dangerous waste and will be managed in accordance with applicable solid waste regulations.

#### **4.6.5 PSR-Provide for Compliance Monitoring**

Lehigh will conduct protection, performance, and confirmational monitoring as described in Section 4.3.5.

Because the CKD removal activities of PSR pose special safety concerns for workers, Lehigh's construction monitoring plan will include additional protection monitoring during construction. Additional worker training and equipment will help mitigate work space hazards associated with excavation in soft materials in a landslide area. Along with these hazards, the nature of the excavation increases the exposure of workers to CKD and CKD-affected water, requiring additional worker safety and protection monitoring.

#### **4.6.6 PSR-Use Permanent Solution to the Maximum Extent Practical**

##### **4.6.6.1 Introduction**

This element for selection of cleanup actions requires consideration of the criteria used in the disproportionate cost analysis (WAC 173-340-360(3)). Each criterion from the disproportionate cost analysis is discussed below.

##### **4.6.6.2 PSR-Protectiveness**

As described in Section 4.6.2, PSR will protect human health and the environment by meeting cleanup standards. Under the first groundwater treatment scenario, PSR will attain groundwater cleanup levels throughout the entire Site. Under the second scenario, PSR will attain groundwater cleanup levels at a conditional POC. In addition, PSR complies with applicable state and federal laws.

PSR does, however, pose significant safety risks during construction. It also requires managing approximately 270,000 cubic yards of CKD on a five-acre site pending transport to a disposal facility. Approximately 10,000 cubic yards of CKD will be disposed of at a remote off-site facility. Rail cars or loaded trucks could be used to

transport the CKD to the disposal facility. Rail and truck transport of the CKD were evaluated for PSR. Truck transport was selected for PSR because it can be implemented more rapidly for less cost than rail transport at the Site. Reactivating the rail spur near the Closed CKD Pile would be time-consuming and expensive. Hundreds of trucks are needed transport the CKD several hundred miles on public roads to the disposal facility. In addition, because PSR incorporates P&T components, it will generate groundwater treatment residuals requiring management and off-site disposal.

#### 4.6.6.3 PSR-Permanence

**Permanent Solution.** As noted above in Section 3.2, Lehigh and Ecology disagree whether PSR is a permanent solution. Ecology believes that it is, because it removes source material from the Site to an extent that groundwater treatment would not be required except to treat residual effects. For purposes of evaluating PSR in this revised dFSTR under the first scenario, given Ecology's belief, Lehigh assumes that cleanup levels will be met in groundwater throughout the Site after five years, at which time treatment will stop.

Lehigh does not believe that PSR is a permanent solution because two types of "further action" will be required after CKD is excavated. First, the excavated CKD will have to be transported to a permitted off-site disposal facility, where it will be isolated and monitored in perpetuity. Second, Lehigh believes groundwater treatment and monitoring must continue indefinitely to meet cleanup levels at a conditional POC for groundwater.

**Permanence.** PSR exhibits a higher degree of permanence than the other alternatives, because it has the greatest potential to reduce the volume of hazardous substances at the Site by removing CKD in contact with groundwater. The GWC components of PSR also permanently reduce the toxicity and mobility of hazardous substances by lowering pH and precipitating arsenic out of groundwater. Assuming that the PSR effectively removes CKD from inundated areas, PSR has the highest degree of permanence, and is therefore the baseline alternative to compare with the other alternatives.

#### 4.6.6.4 PSR-Cost

Using the first groundwater treatment scenario, the present value of this alternative for 30 years at an annual discount rate of seven percent would range from \$18.8 to \$25.6 million (see Exhibit 4.6-2). The estimated cost to design and install PSR ranges from \$17.4 to \$24.2 million (US \$2005). The first five years, while GWC operates, have an estimated annual operating and maintenance costs of \$230,000. After five years, the estimated annual operating and maintenance costs is \$53,000.

Under the second groundwater treatment scenario the present value is between \$20.4 and \$27.2 million. The estimated cost to design and install PSR ranges from \$17.4 to \$24.2 million (US \$2005). Annual operating and maintenance costs are estimated to total \$230,000.

Exhibit 4.1-7 includes the estimated costs of PSR for the three project-duration and discount-rate costing scenarios described in Section 3.2.3.2.3. See Appendix E for supporting information, including assumptions used in the cost analysis.

#### 4.6.6.5 PSR-Effectiveness Over the Long Term

PSR will be effective over the long term under either groundwater treatment assumption. Removing CKD in contact with groundwater will reduce risks at the Site by decreasing the amount of CKD-impacted groundwater. In addition, P&T is a reliable technology for remediating residual CKD-impacted groundwater, and the Pilot System has already proven successful at remediating groundwater at this Site. Lehigh will operate and maintain the GWC components as long as necessary to maintain compliance with cleanup standards. P&T components could be added or decommissioned as needed, and could easily be replaced as necessary. Lehigh would provide a financial assurance mechanism to cover long-term operation and maintenance.

#### 4.6.6.6 PSR-Management of Short-Term Risks

PSR has significant short-term construction risks. Because of the construction requirements, implementing this alternative has significant challenges, as follows:

- CKD is a soft soil that is prone to sliding along the excavation side slopes.
- Controlling subsidence during excavation is difficult. Surface subsidence will compromise the integrity of the existing cover systems.
- Advancing sheet piles into the toe of the Closed CKD Pile may destabilize the face of the Closed CKD Pile.
- Dust control methods such as watering the CKD produce large areas of worker exposure risks. Additionally, water usage may reduce CKD stability.
- Without sufficient dewatering, the CKD is likely to liquefy in response to vibration and heavy equipment movement, producing unstable slopes and an extreme safety hazard.
- Prior to backfilling or disposal, the excavated and stored CKD requires large-scale mitigation and containment measures. The approximately 13,000 truck loads needed to transport approximately 270,000 cubic yards to the temporary storage site will be stopped and cleaned to reduce CKD tracking off-site. In the process of excavating such a large volume of the pile, PSR will require approximately five acres for temporary storage. The lined storage pad of about five acres collects water that drains from the CKD. This water will require handling and treatment. Dust will be controlled using tarps and water. After the excavation is complete, a slightly lesser number of trucks will transport the CKD back for backfilling into the excavated pile. Additional trucks will then transport the excess CKD to an off-site landfill for disposal. The abandoned temporary storage facility requires a thorough

decontamination procedure. The land surrounding and below the storage pad requires testing to confirm that CKD was not transferred to the five acre storage location.

#### 4.6.6.7 PSR-Technical and Administrative Implementability

##### 4.6.6.7.1 *Technical Implementability*

Although PSR is technically implementable, it poses the greatest construction challenges. The construction methods are conventional and technically implementable, but as discussed above excavating approximately 270,000 cubic yards of CKD, much of it soft and saturated, presents significant safety concerns for workers and equipment. Lehigh will select highly experienced workers and sub-contractors and require that progress is slow and in accordance with plans that mitigate risks.

Additionally, the PSR techniques do not offer flexibility to remove more CKD once the saturated portions of the bottom of the Closed CKD Pile are exposed; the targeted areas are decided prior to implementation, and the excavation is tailored to address the target areas. Lehigh will determine the areal extent of the excavation beforehand to maintain the necessary excavation side slopes prior to installation. If saturated CKD extended beyond the excavation footprint, it will not be possible to remove this additional saturated CKD without re-configuring the entire excavation.

##### 4.6.6.7.2 *Administrative Implementability*

PSR requires significant administrative efforts to secure access to property needed to execute the alternative, more extensive than those noted for ASC. The project involves much heavy equipment, storage area(s) for the excavated CKD, and drainage structures for the dewatering wells and water expelled from the stored CKD. It is not known whether Lehigh can obtain access or title to the approximately five acres of land needed to store the excavated CKD. An NPDES permit is required to discharge treated water from the GWC and from the construction activities (i.e., dewatering, CKD drainage, etc.).

See Exhibit 3.2-1, which shows the permits and approvals needed for GWC. Lehigh's preliminary research suggests that PSR will meet the conditions connected with these permits and approvals.

#### 4.6.6.8 PSR-Consideration Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

#### 4.6.7 PSR-Provide a Reasonable Restoration Time Frame

Under the first groundwater treatment scenario, groundwater will meet cleanup levels throughout the Site at a standard POC within five years. As described in Section 4.6.1, Lehigh believes that groundwater treatment continues indefinitely. Under the second scenario, it is difficult to precisely estimate when groundwater will meet cleanup levels for at the proposed conditional POC for groundwater, but that timeframe is not expected to be longer than other alternatives. The performance and confirmational monitoring components allow Lehigh and Ecology to monitor progress. The detailed design phase will more fully evaluate the restoration time frame for PSR.

#### 4.6.8 PSR-Consider Public Concerns

The public will be given an opportunity to review and comment on the dFSTR. Ecology will consider all public comments before finalizing the dFSTR.

#### 4.6.9 PSR-Prevent Domestic use of CKD-Affected Groundwater

Measures to prevent domestic use of CKD-affected groundwater are discussed in Section 4.3.9.